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ABSTRACT

From the systems viewpoint, educational planning is the mechanism through which the educational system makes its goals specific and adapt its priorities, resources, and operational patterns to the changing environmental forces of its particular society. The systems-oriented administrator is a change agent and innovative strategist who delegates responsibility for basic operations and places a premium on executive functions concerned with goals, planning, and coordination. Application of the systems approach to education includes development of alternative plans for optimum resource utilization, generation of models to clarify system relationships, and mastery of quantitative analytic techniques. Major components or subsystems include: (1) goals and priorities setting, (2) resources, (3) control, (4) client service, (5) educational manpower development, (6) environment relations, and (7) student manpower reentry and retraining. Newer tools available to the systems-oriented educational administrator include techniques related to planning control (PERT and PPBS) and serendipity, the art of discovering and utilizing the unexpected. (JK)

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SYSTEMS ANALYSIS AND ITS RELATIONSHIP TO EDUCATIONAL PLANNING

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The power of ideas is often lost in the glitter and glamour of gadgets. It is the idea which gives rise to its physical representation. It was the cluster of ideas called science that generated the hardware and ensured the safe journey to and return from "Tranquility Base" on the moon. Progress in education is related in an intimate way to the concepts and approaches available and used. It is my contention that we have gone as far as we can with existing concepts. If there is to be any breakthrough it will have to come from a new way of thinking. It is argued further that the power of the ideas represented by the systems approach can help the education profession to resolve some of its more complex issues. They can be perceived as a new potential.

"Intelligent cooperation with the inevitable" is one way to define planning. This implies that change will come to all institutions whether it is prepared for it or not. The prudent and far-sighted administrator prepares his organization to cope with new demands. "Rationality in pursuing missions" summarizes the substance of systems analysis. The systems approach is a way of perceiving an organization as well as a set of objective techniques

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capable of contributing something significant to a variety of processes useful to an executive, such as planning and decision making. The process of planning and the concepts and techniques of systems analysis have a common base in science. They are part of what can be called an intellectual technology. The emphasis in this paper shall be on ways of thinking about problems rather than on machines, gadgetry, or hardware per se.

Nature of Planning

Planning is future oriented. It is a process of anticipating what kind of environment will exist, what major forces will operate, what new problems will be generated, and what magnitude or variety of resources will be necessary at some future point in time to minimize dysfunctions and maximize the productivity of an organization. The more radical the anticipated change, the more critical the quality of planning becomes. It is hardly a new process and can be traced to the primitive man who began to wonder how to gain his next meal. Few argue against the importance of planning. The execution of the process, that is, the skill demonstrated in the utilization of its tools and techniques, is of no less importance than the commitment to do something about the future course of events.

The rapidity of change and the complexity of the environment confronting organizations intensified the need for more extensive and more sophisticated approaches to planning in educational institutions. Operating on the basis of purely visceral judgements,

that is hunches, about what schools will demand 5 or 10 years hence is about as useful as predicting the future by studying the entrails of a freshly killed chicken. Systems analysis is one way of gaining the added sophistication required to cope with ever-increasing challenges that confront the schools and their administrators.

A society in ferment generates uncertainties. These, in turn, alter missions, modify priorities, and change procedures. Planning is one way of coping with uncertainties. The more turbulent the society and the more complex the organization, the more necessary it becomes for the administrator to dedicate a larger portion of his over-committed time schedule to planning functions.

From the systems point of view, planning is the mechanism through which a system adapts its goals, priorities, resources and operational patterns to environmental forces. In other words, it is a vehicle for systems change top management has come to recognize as a function of prime impotance in the organizational scheme of things. As a person moves up the organizational hierarchy, relatively more of his time should be devoted to planning activities and consequently less to other administrative interests. The chief school executive, to translate this into educational situations, is the chief school planner. This is not to imply that top executives execute such functions in a vacuum, that is, isolated from the main stream of organizational activity. Inputs from day to day operations must be made available to the top level planners who define future organization-

al roles or sharpen its relationships to existing and anticipated environmental systems. Without the constant and continuing contacts with present operating conditions, no executive can know where the organization is much less where it is going.

The process begins with the specification of missions to be accomplished either presently or at some future point in time. Clarification of goals to be pursued and priorities attached to each are initial outcomes. Goal orientation is so closely related to planning, that often no effort is made to separate the end product from the process. Some writers stress the need for developing a hierarchy of plans ranging from broad statements of goals and objectives that serve as guide lines for top echelon executives to specific statements of detailed operating instructions for each of the subdivisions within the organization. Characterization may be made on the basis of time, namely, long range and short range plans. The taxonomy may result in grouping the outputs on the basis of plans for repetitive activities, such as standard operating procedures, or plans for non-repetitive projects, such as plans for a new school plant. In all cases, one objective is purposeful preparation culminating in a decision which serves as the basis for subsequent action. Planning activities in most institutions, and schools are no exception, in years gone past must be judged to be neglected, pedestrian, and not as realistic as is necessary to cope with the complexity of society and the rapidity of change. More often than not, the typical planning

activities in educational operations fail to generate the criteria upon which to render judgement when confronted with difficult choices and are linked poorly to the fiscal implications of decisions. In other words, education today is criticized for the type of planning that fails to generate the information and interpretations essential to prudent decision making, particularly on a long range basis. It is argued that if educational institutions are to remain relevant to the needs of society, then more sophisticated approaches must be designed, more time and talent must be dedicated to these tasks, and a higher priority must be attached to it. The systems approach provides a conceptual base as well as a store house of sophisticated techniques based on quantitative reasoning to facilitate the function, but a change in the value system of the administrator must accompany a new planning science if maximum advantages are to accrue.

Planning enables the administrator to decide in advance what will be done. It calls for the attainment of a hierarchy of objectives within certain time constraints and resources. The plan is the end product. Stated differently, a series of decisions is reached as the culmination of purposeful preparation. As an intellectual process its successful accomplishment demands creative thinking and imaginative manipulation of many variables. Techniques vary with the personality of the administrator and his situation. Administrative style may be constrained where either there is not enough time to focus on the task or there is limited skill in execution.

The systems oriented administrator by definition is future oriented and mission oriented. He is characterized further as a strategist who places a premium on those executive functions related to goal orientation, planning, and coordination. Stated negatively, he is not a tactician engaged primarily in day-by-day operating decisions to the neglect of developing strategies for the long term that will influence the course of the institution. Efficient operation of present programs is not ignored but delegated to other administrative officers of the system.

This implies that the chief executive committed to the systems approach in school administration is a futurist. He seeks to anticipate the impact of various forces acting upon education and to influence and control the direction of change. Nor can the functions be discharged adequately by one man acting alone. A planning staff must be trained and organized, preferably with a variety of capabilities and representing men of different disciplines.

Implied in the arguments presented is that the modern day administrator is judged no longer, as was his historical counterpart, by merely how well or efficiently he operates the system at present levels or as a maintainer of the status quo. Recognizing the dynamic quality of institutions in a troubled world, a key role for the administrator is that of a change agent. He is a prime agent for innovation.

Bureaucracy has been recognized as giving an organization high productive capacity but a given level of development. It is now under attack as a model for staff organization and administration with relatively low innovative capabilities. Max Weber's bureaucratic model was designed to overcome the human frailities by institutionalizing authority and working procedures to the neglect of maximizing creativity. If schools are to be organizations with increased capability to generate and implement innovations, then new organizational patterns must be designed.

Where innovation is a way of life, planning becomes doubly important. To translate effective planning into reality, special skills and insights must be gathered. Among these is sharpening the ability to predict the future, that is forecasting. This, too, is an age old problem. Man has read tea leaves, gazed into crystal balls, interpreted the significance of the movement of the stars and planets, and called upon oracles in an effort to better comprehend what lies ahead. The systems approach represents a more scientifically oriented effort in dealing with the future. It lacks the mystery and romance of astrology and mysticism but it is a more defensible and more reliable set of techniques. The systems approach is a means of anticipating new environments, developing plans for coping with emerging expectations, and maximizing benefits from resources allocated for reaching various goals. It is, therefore, intimately related to the planning function.

Systems Defined and Described

Systems analysis, systems approach, and operations research are repeating the history of other new ideas that struggled to acquire standard meaning. It is not unusual to find the terms defined by the whim of the user. At present systems analysis is the most popular. For the purposes of this paper, analysis is only one dimension of the total approach. A preference is declared for the term systems approach which the following components are included under: systems design, systems operations, systems evaluation as well as systems analysis. Systems analysis is a subset of a universe and has a restricted meaning. It bears a close relationship to operational analysis, that is a quantitative oriented study of a system.

Systems concepts can be traced to the Gestalt psychologists of almost fifty years ago who helped popularize the observation that the whole is greater than the sum of its parts. This is hardly startling, and certainly not original with the systems analyst. Many have declared the wisdom of examining the total situation before attempting to do something about one element within it.

A system can be defined simply as any collection of persons with resources, a plan, and a goal. The various elements within it are ordered and arranged to accomplish a stated mission in a particular way. Scheme, network, and organism may be used as substitutes for the word system. A system may be pictured as a device for converting inputs (such as manpower, machine power, space and money)

into desired outputs. All this is done according to a plan and any constraints that apply must be spelled out. Components within a system are interactive and interdependent.

Stated another way, every system has boundaries. There is an environment that surrounds it--a kind of a skin that separates the unique entity called a system from factors outside it. If there is interplay between factors within and those outside the system, it is called an open system. If there is no interchange, that is, the boundaries of the system are impervious to exogenous forces, it is called a closed system. Closed systems are unstable in the long run for they lack the mechanism to sense changes in the surrounding environment which have implications for the effectiveness of internal operations.

The systems approach demands at least the following:

(1) both long- and short-range objectives must be identified, specified, and described with the preciseness necessary to serve as guides for operational activities and evaluation; (2) alternative plans or means must be developed for utilizing resources available to attain various missions within the known constraints; (3) models must be generated to better understand the key elements and relationships within the system or subsystem; (4) interdisciplinary teams of specialists must be organized as needed to resolve complex problems; (5) quantitative analysis techniques must be mastered and related to the problem situation; and, in general, (6) decisions are based on scientifically oriented procedures,

particularly, cost-effectiveness analysis of the several meaningful alternatives available.

The systems approach is a way of looking at things, a way of asking questions of certain types, as well as a team effort or set of quantitative analysis techniques. To begin with, it is a highly rational and scientific way of looking at things. This implies that much of the romance that surrounds a given field of inquiry is stripped away as one probes for an analysis of the key elements or facts involved.

That institutions are dynamic, new priorities will emerge, the whole organization must be in mind, change will continue, and anticipation of future demands is important have been heard many times before and from many sources. This suggests to some that systems may be more a packaging of some established ideas; a new package with an emphasis on quantitative analysis techniques being added.

All this has implications for the systems oriented administrator. A new set of priorities are required in his overcrowded schedule. These would include taking the time and effort necessary to do some long-range planning; recognizing the importance of his change-agent role; devoting the energy necessary to insure coordination of the various contributions of interdisciplinary specialists and special units; planning for the analysis of key problems; developing an administrative team with systems capabilities;

and organizing procedures for systems monitoring, control, and corrective actions. New roles mean less time for other functions. The administrator follows the principles of "management by exception" in day-by-day operations, that is, the top level executive is involved in operational details as exceptions arise. This implies that the administrative staff must be large enough and varied enough to accomplish these tasks.

The ability to generate and to use models is important for the systems oriented administrator. Models can be used to predict as well as to explain certain events. A model is a representation of reality, a simplified version of the real world containing only those elements which are of importance to better understanding, control, or prediction. It is built by identifying key elements in understanding, explaining, or controlling any situation and by specifying the pattern of relationships between important variables. One of the model's virtues is its focusing effect. It is a means of rising above a morass of complex details, not all of which are relevant to the comprehension of the essence of the situation under study. Models, therefore, are key concepts organized and related to each other so as to help a person to do some systematic reflection about the situation. One of the keystones of scientific maturity is the creation, testing, and use of models.

A New Way to Look At Educational Systems:

It may be painful for some to view the educational institution as a kind of a delivery or conversion system. This is done not to offend those more romantically inclined but rather to sharpen our perceptions. The institution may be perceived as a network of interrelated subsystems. Each subsystem is charged with the responsibility for accomplishing part of the task of converting inputs available into outputs desired by the individual and society. The educational enterprise can be conceptualized as a unified systematic vehicle for translating resources in the form of money and people into outcomes or outputs related to the goals of society. Its major components can be identified as: a goals and priorities setting subsystem; a resources subsystem, a control subsystem, a client service subsystem, an educational manpower subsystem, an environment relations subsystem, and a student manpower reentry and retraining subsystem. Let me expand on each of these.

The "Goals and Priorities-Setting Subsystem" is concerned with specification of educational missions and/or reordering of priorities for goals to be emphasized within it. By and large, this particular subsystem is poorly defined. Participants in the process are diffused, and relatively great difficulty is experienced in identifying truly potent influence leaders, either as groups or individuals. There is usually some degree of uncertainty as to who is clothed with authority to articulate goals. This may help to

explain why goals change slowly and priorities are reordered less frequently than the turbulent times would suggest. On occasion the national government, in the process of allocating funds for specific educational purposes, may behave as the "Goals and Priority-Setting Subsystem" for local schools. Concerns for "national control of education" stem, in part, from efforts of the national government, rather than the provincial or local school board, to assume the role of the agency that determines what goals and priorities shall be attached to educational efforts.

Outputs of the "Resource Subsystem" are determination and allocation of human, physical, and fiscal resources required in pursuit of various educational missions. The instructional staff is part of this subsystem and staff evaluation is an element therein. Every system pursuing goals requires and consumes a variety of resources. The more complex its objectives and the more dynamic its growth, the more voracious its appetite for resources. The "Resources Subsystem" is usually rather well-defined, structurally and legally. Thus, provincial laws may determine what kinds of taxing authority shall be available for school purposes and within what limits; what qualifications shall be demanded of teachers employed for instructional purposes in schools; the limits of procedures for borrowing; and the like. What is called personnel administration with its elements of recruitment, employment, assignment, evaluation, and transfer of manpower resources is part of this subsystem.

The "Control Subsystem" focuses on sensing the rhythm of operation and on plans for triggering adjustment necessary to keep the system locked onto attainment of stated targets within limits of predetermined permissible variations. Control may be institutionalized in one or more agencies at the local, state, or national levels. Thus, the control may be vested in a school board, the provincial department of education, or provincial government. Less well-defined are the limits of deviation before actualizing correcting mechanism. This does not, of course, preclude the operation of informal control mechanisms as well. Control is an important aspect of systems and its purpose is to prevent system dysfunction.

The "Client Service Subsystem" is the reason for creating the institution. It is the payload. Its output is a better educated and better prepared student, as measured or implied in goals and priorities set. It is that dimension of the total system which identifies, receives, and involves learners in experiences judged to be educational. Typical conceptualization of the educational institution is in terms of this particular subsystem. Instructional personnel, recruitment, employment, and assignment must be geared to the demands of this subsystem. It is usually well-defined and institutionalized by law in the form of school districts and attendance centers.

The "Educational Manpower Subsystem" prepares and develops instructional personnel for entry into the "Resources Subsystem" and

for service in the "Client Service Subsystem." It is basic to successful operations, and no country can hope to extend the range of its "Client Service Subsystem" without a change in the "Educational Manpower Subsystem." This will be true until new technological developments enhance the contribution of physical capital in the educational process. The teacher manpower subsystem in the United States was designed in rudimentary form in the nineteenth century and has been in operation ever since. It is significant that control over the teacher manpower subsystem is usually outside the purview of both local and provincial school boards. At one time some very large cities in the United States, such as Chicago and St. Louis, had their own teachers colleges under the control of local boards of education, which prepared teachers needed for system operation. Interplay among the "Resources" and "Client Service" and "Educational Manpower" subsystems should be evident, even though the first two are parts of one institution in society and the latter is assigned to another.

The measure of the "Environment Relations Subsystem" is the degree of meaningful and efficient interchange between various subsystems and the surrounding environment. If the educational system is to react to forces, it must design a mechanism to sense the magnitude and urgency of exogenous forces and to translate each into adaptive implications for the general education system. This

subsystem is usually poorly defined. Doubtless in these turbulent times, a more sophisticated mechanism will have to be fashioned to ensure responsive changes to stay in tune with the environment.

The function of the "Reentry" subsystem is to enable the participant of the general educational system to move from his relatively protected environment to the world of productive labor. Effectiveness can be measured by success in placement of students who attended for various periods in productive and satisfying enterprises in society. This subsystem has been loosely defined and usually is outside the formal educational system. It may well be the most neglected subsystem. Most schools demonstrate little more than passing interest in job placement and even less in retraining responsibilities for those whose skills were made obsolete by technological developments.

A diagram of the school as a conversion system and its related subsystems is shown on page 17.

The use of system and subsystem may create some degree of confusion. The given frame of reference determines which is appropriate. In other words, what is called the system at one point may be a subsystem in another context. Thus, what can be called an evaluation system may be referred to as a subsystem of the educational resources system. The resources system may be in turn a subsystem when one speaks of the total educational system. The educational system may be perceived as a subsystem of a social system, etc.

COMPONENTS OF THE SCHOOL AS A CONVERSION SYSTEM

INPUT

SPACE

MONEY

TEACHING MANPOWER

STUDENTS

EQUIPMENT

THE SCHOOL SYSTEM AS A CONVERSION SYSTEM

OUTPUT

BETTER EDUCATED PUPIL

BETTER COMMUNITY OR NATION

IMPROVED SCHOOL COMMUNITY RELATIONS

INTERRELATED SUBSYSTEMS

GOALS AND PRIORITIES SETTING

RESOURCES

CONTROL

CLIENT SERVICE

MANPOWER DEVELOPMENT

ENVIRONMENT RELATIONS

STUDENT MANPOWER REENTRY AND RETRAINING

Other Dimensions of the Systems Approach

In addition to viewing the educational enterprise from a systems perspective, the approach contributes a cluster of tools, methods, procedures, and techniques that enhance the capabilities of school executives. To illustrate, the emphasis on an interdisciplinary task force for developing ways of resolving complex problems is an important aspect of systems. The different specialists contribute models and techniques characteristic of their fields. The new approaches may provide the impetus necessary to achieving breakthroughs. No scientist can permit himself to be trapped to the devotion of his model without testing it in the world of reality. If it fails to describe the real world it is the model and not the real world that is changed.

There are various types of models ranging from the well known physical models to the more sophisticated mathematical models, which are a special type of the symbolic models. With a mathematical model, more precise computations can be made.

The model also facilitates trying out of ideas that is simulation of the occurrence of events. Planning can be made more fruitful where there is question as to the appropriate course of action, that is, which alternative will yield the highest payoff. Through the simulation process, which is based on a model, the administrator can "try out," so to speak, the various courses of

actions, and if his assumptions are close to reality can determine the consequences of varying approaches.

PERT (an acronym of program evaluation and review techniques) is another systems tool which can add a degree of sophistication to the school executive as a planner. It is useful in predicting likely snarls in complex projects. It is an administrative device for initially facilitating planning and subsequently controlling projects. PERT calls for a work breakdown of complex programs, assignment of sequences in the performance of various tasks, scheduling of interrelationships, and computation of time required to accomplish activities so that the objective is completed within the resource and time constraints. As a planning-control tool PERT can be viewed as an organized attack that calls for breaking down the project into interrelated and meaningful units. Time does not permit the complete detailed explanation of this planning device, sometimes called 'network modeling,' that can be adapted readily to educational operations.

PPBS, the Planning Programming Budgeting System or Program Budgeting is another systems tool which can be employed in educational planning. It is concerned specifically with resource allocations to enable an administrator to determine the optimal alternative for utilizing scarce resources to attain a variety of goals. Recognizing that goals cannot be accomplished within short periods, a

time dimension is included in PPBS. Multi-year planning, with the stipulation of how much could hope to be accomplished in the traditional one-year slice of time, is a characteristic of this systems technique. To some estimating what will happen in the distant future is frustrating. Even five years in the future is a long time and it is implied that few persons pay much attention to the plan of action developed five years previously. The likely inaccuracies are not the point. The significance of long-run projection is that it stimulates thinking of long-term commitments. These may or may not reinforce commitments that appeared reasonable in the short run. The continuity of planning deserves to be stressed, as well. Projecting plans into a five-year future period does not imply that the task is accomplished once and for all. Rather it suggests that as new data become available the future plans are updated, modified or replaced. Planning then becomes a continuous activity of relating organizational activities toward goals. PPBS plans for a single year, again, is simply one slice of a multi-year of planning approach.

Serendipity is the art of discovering the unexpected. Elton Mayo sought to determine the effect of lighting and fatigue on the productivity of workers and stumbled onto the informal and social relationships among workers. Roentgen inadvertently left a key on a well-wrapped but undeveloped photographic plate and discovered x-rays. A by-product of planning may well be the unexpected bonanza.

Although related to planning, and an outgrowth of it, programming is a strange and often misunderstood activity. Clarification of objectives is an important first step, but additional work is required to translate the objective into an operational reality. Programming is used in the non-computer sense of the term and means the translation of a plan into a series of specific activities related to a mission. The clustering of roles and functions is on the basis of output-oriented activity. The program plan spells out who should do what when.

PPBS can be seen as a conflicts resolution device. There is a disparity between what is demanded of education and what can be done with the resources at hand. The planning and programming processes help to frame the issues for subsequent fiscal and systems analyses. It also sets the stage for accountability for results.

A Summary and Some Final Observations

Planning for the future is a significant process in the systems approach to administration. By the same token the range of systems tools and techniques can help to add a high degree of realism and sophistication to the planning functions. The chief school executive is perceived as playing the roles of the chief architect of plans, change agent, and leader of the interdisciplinary team.

Systems is an intellectual technology. Administrators are called upon to develop new skills and insights to take ad-

vantage of systems. Although more is heard about systems in education, few have developed the expertise necessary to implement it. The approach is more likely to flourish where certain conditions prevail. Some of the more pressing improvements in education to bring a greater degree of readiness to use systems are:

1. The preparation of a more definitive set of educational objectives. Statements that now exist are much too general and too global in scope. Educational missions or goals that can be defined in performance terms will be necessary to further systems capability in school administration.

2. The generation and use of models of at least parts of school operations. Attitudes favorable toward the use of, and skills in the generation of, models of various aspects of educational operations must be stimulated. Very few models of education exist and few administrators think in such terms.

3. Development of quantitative reasoning and analysis capabilities. Powerful mathematical tools and models can be used only by those with special skills and ability. Mathematics, heretofore, has not been considered important in the preparation of special types of administrators or administrative assistants.

4. Greater emphasis on generating alternative means to utilizing resources to attain objectives. Generating many ways to approach a solution to a problem and analysis of consequences of each can enhance decision-making capabilities of administrators.

5. A significant increase in administrative staff strength in local school districts for planning and systems analysis. Present numbers in the superintendency are hardly adequate to cope with existing operational problems. This is not a call for more of the same but for addition of administrative specialists who can generate alternatives, who can frame problems to facilitate prudent decision-making, and who have the concepts and skills in utilization of systems techniques and procedures. Such specialized personnel shall represent extensions or new creations of administrative planning and analysis staffs in school districts.

6. Better vehicles for the dissemination of systems concepts and techniques. It is highly desirable that systems concepts, tools, and procedures be disseminated in education as rapidly as possible. It is my opinion that systems capability will help school administrators cope with complexity and will facilitate prudent change within the system. A massive inservice effort must reinforce some significant changes in the professional preparation programs for school administrators.

There must be literally a systems effort to move beyond the confusion and limited awareness of systems approach in school administration that presently characterize the state of the art. It must be a task-force effort of local school administrators acting in concert with specialized representatives of institutions of higher learning, federal agencies and professional societies.